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ABSTRACT

This four-part guide is designed to help community college instructors understand and respond to individual differences in their students. First, the preface lays out a framework for an in-depth examination of individual learning differences by posing the following questions: (1) Is learning a single function or a composite of different types of abilities? (2) What is the relationship between ability to learn and intelligence? (3) Are individual differences in learning related to differences in students' personality characteristics? and (4) Is there a relationship between the learning assessed in the experimental-laboratory setting and the learning that occurs in the classroom setting? Following section I, which briefly discusses nature-nurture conditions as they relate to individual differences, section II covers cognitive factors, examining intelligence quotient (IQ), types of IQ tests, mental processes, and additional factors influencing IQ. In section III, cognitive style is explored, including types of cognitive style tests; IQ, cognitive style, and instruction; and the relationship between cognitive style and student behavior. Finally, section IV looks at cultural and physical factors that influence individual differences, including a discussion of racial and ethnic differences, physical differences, and physical and social differences in the classroom. (JMC)

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Prince George, British Columbia

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November 1983

A Short Guide To Understanding Individual Differences

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PREFACE

There are phenomenal individual differences in the rate at which students learn. Educators and psychologists have been aware of this, as in nearly all of their studies there are students who learn well and rapidly and others whose progress is timed with a calendar. Instructors are constantly made aware of differences among students in terms of the ease with which they learn a new skill. Students in Grade one are almost always assigned to groups such as the Blue Birds, Red Birds, and the Dirty Birds according to the progress they have made in reading or arithmetic. Students in the top reading groups learn very rapidly, while those in the low groups may need huge amounts of practice and a lot of help.

Is this state of affairs due to the rapid learners also being the brightest students? Probably not, as students in the top reading group are not necessarily the students in the top arithmetic group. Why should this occur? If there is such a thing as general learning ability, we would assume that students who learn one type of material easily would be equally effective with other types of material. How can we account for the fact there are students with above-average ability who find it nearly impossible to learn to read? These questions lead to an interesting topic, that of determining the interrelationships and correlates of student's learning.

To really understand what is happening in the area of individual differences, we have to ask four questions. First, is learning a single function or a composite of different types of abilities? To date we have not paid much attention to the possible relationships between scores obtained in different types of learning tasks. The main reason for this state of affairs is that most teachers tend to focus on a single problem to assess the influence of particular experimental variables. As a result, it is a rarity when the same

group of students have been presented with more than one type of problem. There are data available, however, dealing with the interrrelationships among scores obtained on a variety of learning tasks. These studies generally have been produced by people interested in determining whether learning is a single, global function or whether it is the result of different types of learning abilities.

The second question is, what is the relationship between ability to learn and intelligence? There is a great mass of data to indicate that scores on learning tasks differ for groups differing in level of intelligence. We need to know how pervasive and strong is this relationship.

Question three, are individual differences in learning related to differences in student's personality characteristics? In spite of the practical implications, personality characteristics of effective and ineffective learners is somewhat limited. We do have data on the effects of anxiety and cognitive style on learning, but information concerning the relevance of other personality variables is quite limited.

Fourth and finally, is there a relationship between the learning assessed in the experimental-laboratory setting and the learning that occurs in the classroom setting?

The Guide is comprised of four sections. Section I deals with Individual Differences Related to Heredity and Environmental Conditions, Section II covers Individual Differences in terms of Cognitive Factors. The Individual Differences related to Cognitive Style are covered in Section III. Section IV deals with Individual Differences in Cultural and Physical Factors.

We would be sadly remiss if we did not give our sincere thanks to Linda Fieguth for her excellent work on layout and design of the manuscript on the Word Processor and to Diane Jacobs for the beautiful work on the cover design.

We are also indebted to our colleagues who have made suggestions and comments to help us organize this manuscript.

Duane Rubadeau

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November 1983

SECTION I

INDIVIDUAL DIFFERENCES:

THE NATURE-NURTURE CONDITIONS

Heredity and environment play important roles in individual differences. Unforturnately, we appear to be wasting a great deal of energy and paper attempting to resolve whether the greatest proportion of intellectual functioning is due to hereditary or environmental factors. The point is, that conditions which have a hereditary basis are changeable to some extent by manipulating environmental conditions.

To deal effectively with the concept of individual differences, Gottesman's (1968) reaction range seems to have a great deal of merit. Reaction range refers to the numerous possibilities for intellectual development that fall between the high and low limits, which are hereditarily defined. Within this range, environmental factors and experience are used to explain as well as determine the intellectual functioning level.

The hereditary basis for intellectual functioning is the genotype. Each genotype can give rise to several different phenotypes. Intelligence as measured by test scores would be an example of a phenotype. The phenotypes depend on what kind of environment is available. For example, children raised in an extremely restricted, poverty stricken environment would have little chance of developing phenotypes that are near the top of their reaction range. Conversely, children coming from an environment which is very supportive and nurturant, will have an excellent chance for developing phenotypes at or near the top of their reaction range.

It is important to remember that enhancing the environmental conditions, which in turn, produces a greater possibility of developing phenotypes near the top of the reaction range, does not mean that individual differences will be eliminated.

SECTION II

INDIVIDUAL DIFFERENCES:

COGNITIVE FACTORS

Anastasi, Piaget, Bayley and many other authors have described the differences in performance that can be expected among children of the same age. Instructors at any level in the academic setting are well aware that students presented with the same material come up with a wide variety of scores when they are tested on that material.

When instructors are asked to explain these differences in achievement, we tend to say things such as: "Sam is not applying himself", "Louise is a really bright young lady", or "The lights never came on in George's case". Fortunately, researchers in the field of individual differences cannot get away with making these trite statements. As a result, they utilize concepts such as I.Q. and cognitive learning styles in their attempt to explain individual differences. We feel that a discussion of these factors will help you to understand the cognitive differences that exist among individuals.

Intelligence Quotient (I.Q.)

There are many people who do not understand what their term intelligence quotient means. I.Q. is nothing more than a number that is associated with answers made to a set of questions on an intelligence test. The I.Q. number provides an indication of the individual's ability to perceive, organize and respond to a wide variety of stimuli. For example, the person who is very adept at perceiving, is very efficient in organizing stimuli, and is very accurate in responding to stimuli, will have a high score on intelligence tests.

While I.Q. refers to a number that is assigned to an individual's performance on a set of problems, intelligence refers to the individual's capacity to understand facts and relationships and to utilize them reasonably and logically. I.Q. then, is an observable measure of intelligence. Please keep

in mind that factors such as language differences, anxiety, illness, or fatigue can have a phenomenal influence on the I.Q.. Hence, it is quite possible for a person to have a greater intelligence than his/her I.Q. would indicate.

Types Of I.Q. Tests

There are a variety of tests for determing I.Q. depending on whether you wish to use an individual or group test, verbal or non-verbal, or where the age of the student is a major factor. An important point to keep in mind is that when you use a test for determining I.Q., you have to have a good idea of the mental processes that are measured and to look at the types of items that make-up the test.

Every item on an I.Q. test measures one or more mental processes. For example, mathematical reasoning; verbal reasoning; perceptual discrimination, which is a measure of the ability to see differences between, or compare and contrast two or more conditions; auditory memory, which is the measure of ability to hear, remember and reproduce information; pattern reproduction, which is the measure of ability to reproduce or arrange stimuli to look like a displayed model; error detection, which measures the ability to find errors in a stimulus pattern; and pattern completion, which measures the ability to analyze and extend a pattern.

The following list describes the mental abilities measured by I.Q. tests and the related types of academic activities.

Mental Processes	Definition	Academic Activities
Mathematic Reasoning	Ability to use numbers in solving problems.	Completing math problems, solve physics-type problems, and work out ratios procedures for enlarging or reducing recipes.
Verbal Reasoning	Ability to use language in solving problems.	Completing tests and work-sheets, solving riddles and giving oral answers to questions.
Perceptual Discrimination	Ability to see differences between, compare and contrast two or more conditions.	Naming by shape, provinces and countries, and by sound musical instruments.
Auditory Memory	Ability to hear, remember and reproduce information.	Learning the role for a play or learning a song.
Pattern Reproduction	Ability to reproduce and arrange stimuli to look like a displayed model.	Copying a visual pattern or unscrambling and outline.

Mental Processes	Definition	Academic Activities
Error Detection	Ability to find errors in a stimulus pattern.	Correcting typing errors, proof-reading term papers.
Pattern Completion	Ability to analyze and extend a pattern	Composing a story set on a particular theme or completing an incomplete outline

These skills are vital to students who are attempting to tell the difference between Piaget's concept of assimilation and accomodation or attempting to devise answers for short answer questions. No matter what the age of the student happens to be or the difficulty of the task, the student having the best chance of success on academic tasks is the one who is adept at perceiving, organizing, and responding.

Objective analysis of tests measuring I.Q.'s allows us to come up with two conclusion: First, I.Q. is an assessment of skills that are the basis for learning, which have important implications for many academic tasks. Second, the skills measured by an I.Q. test are such that they can be improved by practice in many cases.

Additional Factors Influencing I.Q.

Hopefully by now, you understand that I.Q. measures can differ with the type of test that is used. In addition, factors such as the students physical state, motivation, understanding the directions for taking the test and the reliability and validity of the test can produce differences in I.Q. test scores.

Family and home conditions may also be related to I.Q. Generalizations related to the family and home influences include: children from limited-education families tend to show a decrease in I.Q. over time, while children from well-educated families have shown small increases in I.Q. over time.

Social class and racial influences have to be considered when attempting to explaining differences in I.Q. The arguments will probably rage on for another century as to whether environmental factors or hereditary conditions have the greatest effect on I.Q. scores. At the present time there is a split among educators as to which of these factors has produced measured differences in I.Q. between Negroes and Caucasians.

Sex and development appear to be related to I.Q. Here, research results indicate that girls often show a decrease in I.Q. over time, especially those who are passive and dependent, while boys who are independent and competitive tend to show an increase in I.Q. as they grow toward maturity.

In summary, the generalization is that I.Q. does change and there are environmental factors that affect a student's measured I.Q. Other factors such as socioeconomic status, parents educational level and the number of siblings have an effect, but are often difficult to explain.

SECTION III

INDIVIDUAL DIFFERENCES:

COGNITIVE STYLE

Cognitive styles refer to ways of perceiving stimuli that are thought to help explain how a student learns and hence are factors that are related to individual differences. Although there are numerous ways of defining cognitive styles, probably the most effective as well as comprehensive definition is that they are distinctive ways of perceiving, storing, transforming and using information. Cognitive style scores coupled with I.Q. scores provide information about the student's intellectual operations. For example, cognitive style scores give an indication of the student's type of cognitive reasoning, while I.Q. scores provide information about skills and abilities. As we pointed out in Section II, there are a number of different types of tests for measuring I.Q. There are also several different tests for measuring cognitive style. Some of the cognitive style tests measure the way the student tends to associate or organize stimuli. Other cognitive style tests measure the perceptual habits the student has developed over time. Finally, some of the cognitive style tests measures the way the student processes information.

Types Of Cognitive Style Tests

1. Field Dependent - Field Independent Cognitive Style

   One of the common ways of measuring field dependence or independence is the embedded figures test. In this type of test, a simple design and several complex designs are presented to the student. Every complex design contains lines that are the same as those in the simple design. Performance is measured by the time it takes the student to discover the simple figure embedded in the complex figure. Students needing a long time to find the embedded figures are referred to as field dependent, while those who are quick to find the embedded figure, have a field dependent cognitive style. In effect then, cognitive style tests of the field

dependent or independent variety, measure the extent to which a student's perceptions depend on the stimulus field or the surrounding stimuli.

2. Reflection - Impulsivity Cognitive Style

A second variety of tests for measuring cognitive style are the reflection-impulsivity tests. An example of such a test is Kagan's - Matching Familiar Figures Test. The Kagan Test is comprised of several standard figures with six alternatives for each standard figure. One of the alternative figures matches the standard figure, the other five are similiar to the standard figure. The student's task is to find the alternative that is just like the standard figure.

The number of errors and the amount of time the student needs for each item are recorded. The reflective cognitive style students are those who take more time and make fewer errors. The impulsivity cognitive style students are those taking very little time and make many mistakes.

3. Analytic - Descriptive Cognitive Style

Kagan et al developed the Conceptual Styles Test in order to measure the kinds of relationships a student tends to make between objects. In this test, the student is presented a set of three pictures and is asked to select the two that are alike and explain why they go together. Whether the student has an analytical or descriptive cognitive style depends on how they associate two physical objects on the basis of similar physical attributes.

4. Categorical - Inferential Cognitive Style

On this dimension of cognitive style, the student associates two objects or events because they have the same type of conceptual label. For example, the concept of modes of transportation, fruit, or furniture.

5. Relational Cognitive Style

In relational cognitive style, the student tends to select and associate two objects or events that have a similar function or use.

I.Q., Cognitive Style, and Instruction

A major factor that all instructors should keep in mind is to take into account and respect individual differences in I.Q. and cognitive styles.

As instructors, we should make the supreme effort to get our students to develop a thought pattern that involves: analytical, categorical-inferential, and relational styles of thinking.

Analytical thinking can be developed quite readily by using items where the student has to think about the similarities and differences between two or more things, or has to identify several entities that have some common characteristic. An example of the first type of item: "What are the similarities and differences in the political philosophy between the Liberal and New Democratic parties?" An example of the second type of item: "Identify the natural resources of British Columbia."

The categorical-inferential type of thinking can be developed by using items that assess ability to deal with concepts. For example: "List all of the vegetables or fruits you can think of."

Finally, a relational style of thinking can be developed by having your students explain how two or more things can be used in the same way. For example: "Name two things you could use to indicate danger."

One last comment regarding I.Q. and cognitive style. As an instructor, try to remain open-minded regarding student abilities. That is, I.Q.'s are subject to change depending on a variety of environmental conditions. Hence, labeling

students or placing them into various categories can be very detrimental in many cases.

The Relationship Between Cognitive Style And Student Behavior

Here, we are dealing with generalizations about behaviour patterns of field-dependent and field-independent students. Field-dependent students tend to be more adept at responding to social cues and remembering information related to social settings. Field-dependent students also tend to be affected by criticism, which is a form of social punishment. Field-dependent students appear to be more oriented toward inter-personal career fields such as: social work, languages, sociology. These fields place greater emphasis on human assessment skills rather than emphasizing competence in cognitive analysis. Finally, the field-dependent student tends to use a spectator approach to processing information.

Generalizations regarding the field-independent students indicate that these students are good at symbolic representations that are needed for thinking and problem solving. Hence, the field-independent student tends to do much better in fields such as engineering, science, and mathematics. The field-independent student also is more adept at learning course material that lacks structure, as they tend to analyze, organize and categorize material. For example, the field-independent student is more adept at outlining and organizing ideas from the fields of political science, anthropology and psychology. In effect, the field-independent students tend to impose their own structure upon the information they process, giving that information greater meaning.

We feel it is important for instructors to know about and deal with cultural differences, including race and ethnicity, as well as differences in other social characteristics. We also feel it is important for instructors to know about and deal with physical and sex differences, including handicaps that set some children apart from others.

Racial And Ethnic Differences

Although East Asians, Boat-People, Negroes and Caucasians physically share space in a course or program, the task of integration is not complete. A major problem is that while integration provides a means of sharing and preserving racial and ethnic differences, and hence supporting the idea of our cultural mosaic, it also allows for opportunities for harrassment, ridicule, shame, and fear. In addition to the cruelty shown by students toward other students due to a wide variety of motivational factors, we as instructors, often have cultural and racial biases. These instructor biases are observed in our tendency to favour our own culture and values when selecting the course or program materials and instructional methods. While awareness of one's biases does not necessarily reduce the bias, we hope that awareness of bias will lead to an emphasis on multicultural learning.

While awareness of one's biases does not necessarily reduce the bias, we hope that awareness of bias will lead to an emphasis on multicultural learning. Probably the best procedure for dealing with the multiracial situation is to develop a course or program centred around the objectives of discouraging stereotypes, increasing recognition and more important, acceptance of individual differences, improving understanding of ethnic/racial identities, and developing abilities to make reflective judgments about ethnic/racial problems. Race and membership in an ethnic group are characteristics that set

a student apart in a course or program. We do not know how lasting the effects of this type of program will be, but it is certainly worth the effort.

Physical Differences

Here we deal with those students who deviate from the norm on one or more physical aspects. Although the media have sought to enlighten the public about physical disorders, there are many individuals in our society with physical disorders that are viewed with ridicule, disdain, or horror. Probably the best way of getting students to deal effectively with physically handicapped people is to have them work with the handicapped on a one-on-one basis. In this way they develop a first-hand knowledge of the capabilities and limitations of the handicapped person they would never receive, if they attended dozens of lectures.

As an instructor working with handicapped students, a major set of objectives should be: to set realistic expectations for these students, reward their efforts toward developing independence, and encouraging activities that involve other non-handicapped students. Moving toward these objectives will help the handicapped student see himself/herself as more responsible, self-directed, and scholastically and socially more like their fellow students. What must be avoided, is to make the handicapped student feel helpless. To do this, their sense of dependency on others should be balanced with a feeling of being depended on by others.

In addition to handicaps there are many other ways that physical differences may be noted amoung students. The most common of these differences are height, weight, body build, facial attractiveness, appearance and personal hygiene.

Physical And Social Differences And Instruction

It is very important for instructos to become aware of physical and social differences amoung students and encourage students to notice and accept these differences.

In our multicultural society, students having English as a second language can be assigned peer tutors for written and oral assignments. In turn, they may be asked to teach the class some expressions from their native language. It is also very helpful for the instructor to know about and acknowledge the major customs and holidays of students in a multicultural setting.

Allow for and encourage students of both sexes to work on tasks traditionally associated with the opposite sex. Try to maintain a nonsexist environment.

To drive home the conditions that the handicapped have to work with, consider the possibility of having your students experience various handicaps for a whole day. Slings, crutches, wheelchairs, eye patches and ear plugs can be used to simulate some types of handicapping conditions. This procedure can be followed by a discussion of the physical and emotional feelings as well as the performance experienced by these students.

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